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FARMERS' BULLETIN

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GROWING PEACHES:

PRUNING, RENEWAL OF TOPS, THINNING, INTERPLANTED CROPS, AND SPECIAL PRACTICES.[1]

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PRUNING.

There is probably no other operation in the production of fruit concerning which there are such wide differences of opinion and practice as prevail with regard to the pruning of trees. The fact that trees often produce abundantly and regularly under practically all systems of pruning or with no pruning whatever forces the conclusion that dogmatic statements and rule-of-thumb directions are both unsafe and unwise.

However, as a general proposition, the most successful fruit growers habitually prune their trees, and in doing it they usually follow more or less closely some plan or system, even though they may have no clear-cut conception of just what their plan involves.

In discussing the pruning of peach trees, it ought to assist the reader materially to have in mind rather clearly the various objects that may be accomplished by pruning a tree. Unless one knows why he is pruning and what he expects to gain thereby, he is not likely to do it very intelligently. The principal objects may be summarized as follows:

(1) To modify the vigor of the tree.
(2) To keep the tree shapely and within bounds.
(3) To make the tree more stocky.
(4) To open the tree top to admit air and sunshine.
(5) To reduce the struggle for existence in the tree top.
(6) To remove dead or interfering branches.
(7) To aid in stimulating the development of fruit buds.
(8) To thin the fruit.
(9) To make thorough spraying possible.
(10) To facilitate the harvesting of the fruit.

[1] This bulletin is intended for general distribution. Farmers' Bulletins Nos. 631 and 633 continue the general subject of peach growing and treat of other fundamental orchard operations. In the preparation of this series of bulletins the author has very freely consulted the more important experiment-station literature on the subject, besides referring to many other sources of information. Credit is given wherever the information appropriated is tangible enough to warrant it.

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Obviously the pruning which a tree receives during the first two or three years after it is planted has much to do with its future. Mistakes in forming the head or the results of neglect during the early years in the life of a tree are practically irreparable. On the other hand, if the tree is well formed and properly pruned during its first years, the foundation for a good tree is established; subsequent errors in pruning, if they occur, may admit of correction without permanent harm to the tree.

A question frequently asked is, "When is the proper time to prune peach trees?" In general, the answer to this inquiry is, During the dormant period, preferably in late winter or early spring, just before growth starts, except in regions where bleeding from wounds is likely to occur. In such regions it should probably be done in early winter. But conditions and the object of the pruning must be considered in each case. If the pruning operations are very extensive, economic requirements may make it necessary to prune throughout the winter whenever the weather is suitable for men to work in the orchard. If the fruit buds are endangered during the winter by adverse temperatures, it may be advisable to delay pruning as much as economic conditions permit until settled spring weather arrives. This is especially advisable if heavy heading in of the previous season's growth is involved, since the proportion of live buds may determine the extent to which the cutting back should be carried.

A limited amount of summer pruning can usually be done to advantage. The trees should be observed constantly throughout the season of active growth. Whenever a branch is seen which is so placed that it obviously will need to be removed at the annual pruning for the shaping up of the tree, it is well to take it off at once. In this way the annual pruning can be reduced to a minimum and the removal of large limbs will rarely be necessary.

Then, too, it frequently happens that a single branch in the top of a tree will grow considerably faster than any of the others, thus making the tree unsymmetrical if its growth is not checked. A slight heading in as soon as such a tendency is apparent will usually keep the top well balanced.

The pruning of a peach tree at the time of planting it has already been discussed. A tree well along in its first season's growth is shown in figure 1. It will be observed that the top is formed of four main branches. This tree shows evidence of having received attention during the earlier part of the season. Only those branches which were of importance in forming the top have been allowed to develop. The exact number of branches which may be used in forming the head is not an arbitrary matter. From three to five or six branches are permissible, if they are well placed and properly distributed on the main stem of the tree. The branches that form the head of the

tree shown in figure 1 start from points on the trunk which are rather too close together. If there was more space between the branches where they join the trunk there would be less danger of the limbs breaking down in later years from the weight of heavy loads of fruit.

During the dormant period between the first and second year, the first year's growth, provided it has been thrifty and vigorous, should be headed back rather heavily; perhaps one-half or two-thirds of the growth should be removed. The cross lines shown in figure 1 are intended to suggest suitable points at which to cut the branches when the pruning is done later on. However, this needs to be considered with several things in view: The symmetry of the tree, its strength and vigor, and its future development. In order to anticipate an open, well-formed head in later years, it may be necessary to thin out some of the smaller, secondary branches. In doing this, however, provision must be made for a uniform distribution of limbs so spaced that the open top desired will be insured and yet the main limbs still carry an ample number of secondary branches.

FIG. 1.—A peach tree of the Muir variety during its first season's growth. The cross lines shown in the figure are intended to suggest suitable points at which to cut the branches when the pruning is done later on. (Photographed in California, Aug. 27, 1913.)

Pruning the second and third year does not differ in principle from that which follows the first season's growth. At each pruning, the previous season's growth is headed in, though perhaps not quite as much as at the first pruning. This, however, will depend upon the character of the growth and the condition of the tree. If it is stocky and strong, less heavy heading in will be required to serve the end in view, but long, slender, spindling growth should be shortened back as severely after the second or third season as at the earlier pruning.

At each subsequent pruning the secondary branches require the same attention as at the first pruning. The points which require particular attention are thinning out enough to keep the top open and shortening in heavily in order to produce a new growth of bearing wood evenly distributed throughout the top of the tree and on the interior surfaces of the main limbs.

The effects of not heading in are shown in figure 2. The trees here shown are making their second or third season's growth. They were not well headed in at first, and no heading back has been done since they were planted. Besides, the soil is lumpy and in poor tilth and the trees are making a weak, slender growth. Had they been well headed in, the growth would have been much more stocky, even though the trees were small, and they would be in much better condition to sustain the weight of a crop of fruit than they can possibly be under the system of management that has been followed.

FIG. 2.—Peach trees about 3 years old that have not been headed in. The limbs are slender and will probably break badly with the weight of the first good crop of fruit.

The tree shown in figure 3 has been pruned more or less, but it exhibits serious defects. It has not been well headed in, the top has not been properly opened, and the smaller, secondary growth has been entirely pruned off from a considerable portion of each of the main limbs instead of being utilized to develop fruit-bearing branches in the center, where its weight can best be supported without breaking the tree. With the bearing wood largely developed toward the outer extremities of the branches and the size of the branches disproportionately small for their length, even a small crop of fruit would be likely to break the tree to pieces very badly. This tree may well be contrasted with the trees shown in figures 4 and 5, which have been pruned with a view to developing the characteristics referred to. The limbs are stocky and well proportioned for sustaining heavy crops of fruit. The interior of the trees are well filled with bearing wood and at the same time the tops are sufficiently open to admit a full quota of sunshine to practically all the fruit.

By the time peach trees are 3 to 4 years old they should be bearing good crops of fruit. After this, they will make a smaller annual growth under usual conditions than during the earlier years. Less heading in is therefore required. In some seasons it may not be necessary to cut back the terminal growth, though to do so will tend, as a rule, to develop the smaller secondary and side branches. This is desirable, for reasons already mentioned. Again, the extent of the heading back will be governed in some seasons by the abundance and condition of the fruit buds. If there has been winter injury or if the buds failed to form well the previous season, little or no reduction of the previous season's growth will be needed. On the other hand, if the trees made a strong growth, an abundant set of fruit buds developed, and they have suffered no injury, a corresponding heavy cutting back of the previous season's growth may be advisable, in order to thin the fruit as much as is possible by that means.

FIG. 3.—A peach tree that has been badly pruned. The bearing wood is near the extremities of the limbs. The weight of even a small crop of fruit would be likely to break the limbs to a serious extent.

After a peach tree reaches bearing age, the fundamental principles underlying pruning are based on the fact that the fruit is always borne on wood that grew the previous season. It is, therefore, essential so to manage the trees as to induce a fairly liberal growth each season.

As a general proposition, very heavy pruning will induce a correspondingly large amount of new wood growth. It follows that the weaker growing varieties should be pruned more heavily, relatively, than the very strong-growing sorts.

Some of the details of pruning mature peach trees are suggested in figures 6 and 7, which show a tree 8 years old before and after it received the annual pruning to make it shapely, remove superfluous wood, and provide for the development of new growth. While the tree illustrated is far from being ideal, as it had not been well handled in previous years, it shows certain important features. The heading

FIG. 4.—A Levy peach tree 8 years old pruned with a view to developing strong, stocky branches and an open top. (Photographed in California, Aug. 28, 1913.)

FIG. 5.—Phillips peach trees 10 years old. These trees have been systematically headed back, and strong, stocky limbs have developed. It is necessary, however, to prop them when very heavily loaded with fruit. (Photographed in California, Aug. 27, 1913.)

back of the main limbs will tend to prevent them from becoming "leggy," and it will induce a good strong growth of new fruit-bearing wood well within the center of the tree. It may require some thinning out at the next annual pruning to prevent the top from becoming too dense. Probably more wood of the previous season's growth should have been left than is shown in figure 7, as there appears to be only a small amount of surface on which fruit can be produced the following season; but apparently the tree has been put in fairly good condition with regard to its later usefulness.

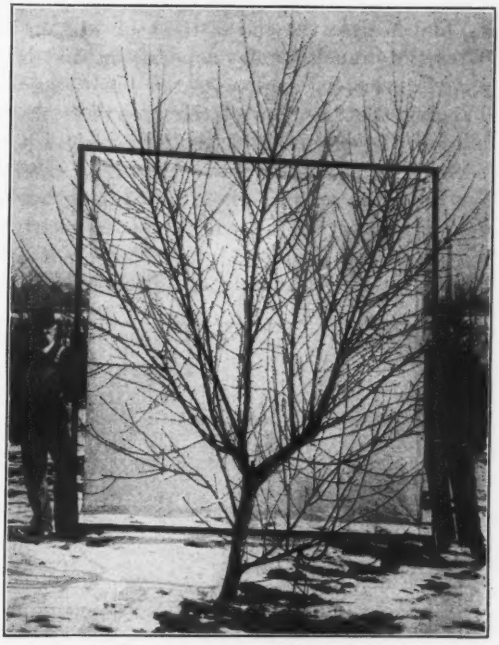

FIG. 6.—A peach tree about 8 years old, before pruning.

The growing of an open-headed tree is not merely a matter of keeping the top well thinned out. The position of the branches can be controlled and directed to a marked extent by the manner in which the pruning is done. Figure 8 shows two Elberta trees which have a rather remarkable spread of limb. Systematic pruning and heading in were practiced in the earlier years of these trees. The spreading habit has been augmented by cutting the branches to outside buds when they were headed back. The significance of this is more

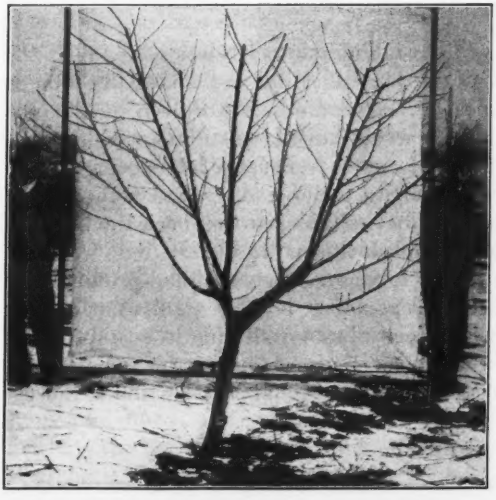

FIG. 7.—The same tree shown in figure 6 after being pruned.

clearly shown in figure 9, which was drawn from life. When the branch was cut back at *b*, during the winter following its growth, the bud nearest the end of the stub was on the outside of the limb. When the branch *b c* developed from that bud the following season, it made a decided angle with the one *a b* on which it developed, thus changing the direction of the growth from that which would have followed the extension of the limb *a b* had it not been cut back, and resulting in a considerable widening of the spread of the branches. The following season, when the pruning was done and the limb *b c* was cut off at *c*, the outermost bud was nearly on top of the stub at *d*. When this bud gave rise to a branch *d e*, the limb *b c* was continued thereby in approximately the direction of the older limb *a b*. The

FIG. 8.—Elberta peach trees 14 years old which have been pruned with a view to producing open, spreading tops. The branches of the two trees together in the foreground have an expanse of about 55 feet. (Photographed in Colorado, Aug. 23, 1910.)

limb *f g*, which developed from a bud at *f* which was not as near the end of the stub as was the bud at *d*, did not materially change the direction of the branch *b c*. Had the bud at *d* been on the outside, the spread of the branch would have been still more widened, as was the case when the branch *b c* grew from *b*, the latter being an outside bud. If it is desired to correct the habit of growth in the case of a tree that is too spreading to be desirable, cutting back the limbs to inside buds will tend to accomplish the end in view.

Heading in a tree from year to year as suggested and pruning with a view to producing an open, spreading, low top results not only in the development of strong, stocky limbs well able to sustain heavy loads of fruit, but it brings a large proportion of the top near the ground, where much of the fruit can be harvested without the use of stepladders.

Before an architect begins to draw the plans for a building he must have a mental picture of the completed structure, at least so far as the main features are concerned. He must know what details are necessary at every step, as he develops the plans, in order to produce the desired results. Not unlike this, the man who prunes a fruit tree during its first years must have a pretty clear conception of what the tree is to look like when it reaches maturity, and he needs to know from the beginning what is necessary each time it is pruned in order to develop the tree which forms his mental vision. Of course, such a picture can develop fully only with experience and as one becomes familiar with the characteristics of growth, habit, and behavior of the different varieties. At the same time a well-formulated plan, based on a knowledge of the underlying principles of pruning, is essential if the operation is to be anything more than a haphazard removal of branches that appear to be in the way.

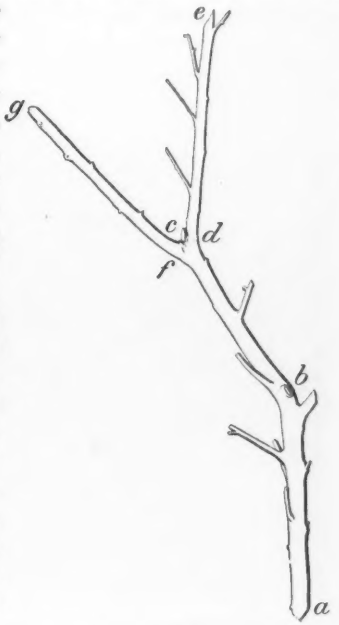

FIG. 9.—A branch which suggests the possibilities of influencing the habit of growth by the position of the bud left at the end when the branch is cut back.

A fruit grower who is a student of his business will devise many useful things that are especially adapted to his conditions and which will greatly facilitate the operations in his orchard. Figure 10 shows a type of stool that is used in one of the Allegheny Mountain peach orchards both in pruning the trees and in harvesting the fruit. The details of construction are readily determined by reference to the figure. The legs spread enough to make the stool stand firm and to give the workman a sense of security when standing on it. When intended for use in an orchard that is located on a very steep slope, the two legs on one side of the stool are made somewhat shorter than they are on the other side.

A sled similar to the one shown in figure 11 is a very convenient device under some conditions for use in removing the brush from an orchard after it has been pruned. Another way of disposing of the brush is shown in figure 12. This device consists of a frame made of piping and lined with sheet iron. It is mounted on iron or steel wheels. The brush is thrown into it and burned as it is drawn through the orchard.

RENEWAL OF THE TOPS.

If a peach tree is neglected as to pruning during its early years and the branches are allowed to become long and slender; if, as it attains considerable age, the bearing wood, in spite of the pruning which it has received, has grown out of convenient reach in harvesting; or, if for other reasons it becomes desirable to renew the top of a tree, it is usually entirely practicable to do so, provided the trunk and main limbs are sound and healthy. Renewal of the top will often result in prolonging the usefulness of a peach tree for several years. This operation is exemplified by several of the accompanying illustrations.

FIG. 10.—Pruning Salway peach trees in an Allegheny Mountain orchard in West Virginia.

Figure 13 shows an 8-year-old peach tree which has become rather "leggy." The annual growth for several seasons has nearly all been made near the extremities of the limbs. Very little new wood has grown in the interior of the tree.

Figure 14 shows the same tree after being severely headed in, or "deheaded,"[1] with a view to developing a new top. The small branches which remain on the stubs of the old limbs are an advantage, as they will start into growth more readily than will the adventitious

[1] The term "dehorn" has been widely used to express this operation. That word is entirely inappropriate and meaningless when used in this connection, even though it may be a perfectly proper and expressive one when used in referring to the removal of a cow's horns. Though this term has been used for many years, apparently with common consent, and, so far as the writer knows, without previous protest, the term "dehead" is suggested as being much more appropriate and one the use of which is sanctioned at least by its derivation, if not by its appearance in a dictionary.

or latent buds from which the new top would have to develop in the absence of small branches of recent growth.

Figure 15 is a third view of the tree shown in figures 13 and 14, well advanced in its second season's growth after being deheaded. It should be stated that this particular tree was somewhat lacking in vigor and its growth following the treatment for the renewal of the top was not as satisfactory as it would otherwise have been. Figure 16 shows a 7-year-old Elberta tree which was thrifty when it was headed back to about the extent indicated in figure 14. This illustration shows this tree near the end of its first season's growth after being deheaded. It should bear a crop of fruit the next season.

If a tree which lacks vigor is treated in this way, the results shown in figure 17 may occur. On a portion of the stubs there were no buds

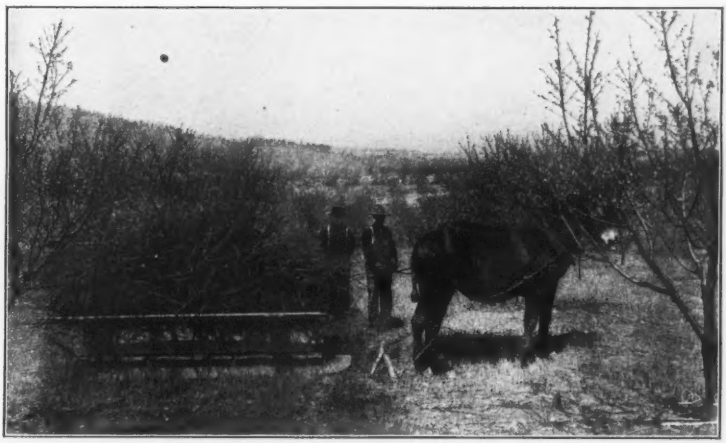

FIG. 11.—A sled used for hauling brush from an orchard. (Photographed in West Virginia.)

strong enough to develop; hence, the top was only partially renewed. If the tops are cut back to wood that is not more than 3 or 4 years old, a stronger, more symmetrical growth may be expected than where the stubs left in deheading are older than the age mentioned. Occasionally, where the trunk remains sound and retains its vigor, the tops are renewed two or three times. As a rule, however, it is impracticable to dehead for renewal more than once.

Sometimes, when for any reason it is desirable to renew the top of a comparatively young tree, the heading in may be made much more severe than that suggested by figures 14 and 17. This is shown in figure 18, where all the branches have been cut back to the trunk of the tree.

The season for deheading to renew the top is the same as that for doing the annual pruning for the shaping of the trees and the removal of superfluous wood.

When the vigor of peach trees has been well maintained by good cultural methods, suitable pruning, and wise management in every respect, their life of commercial usefulness is generally from about 8 to nearly 20 years after the full-bearing age is reached. It varies, however, quite widely under different conditions. In some sections it is rarely profitable to continue them after they reach the age of 12 to 15 years; in others they are expected to last until they are from 15 to 18 or 20 years old, while occasionally an orchard from 20 to 25 years old is found which is still of commercial value. Instances of individual trees remaining productive until a much greater

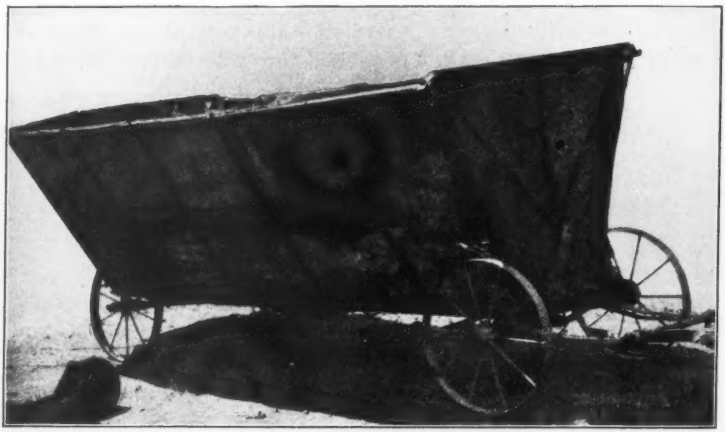

FIG. 12.—A wagonlike device in which the brush pruned from trees is burned as it is drawn through the orchard. (Photographed in California.)

age are not uncommon, but they seldom, if ever, represent orchard conditions.

CHANGING THE TOP BY BUDDING AND GRAFTING.

For various reasons it is sometimes desirable to change the top of a peach tree from one variety to another. A grower may find after his orchard begins to bear that he has a larger number of trees of some variety than he wants; a block of trees may prove to be some other variety than the one ordered; or, for some other reason, a variety is not well adapted to the needs of the owner. In such cases he has recourse to top-working the tree either by budding or grafting to a desirable variety.

The ordinary method of shield budding is the one more commonly used for this purpose. If the tree to be top-worked is not more than 2 or 3 years old it is usually practicable to insert the buds directly into the main limbs well down toward the point where they leave the trunk. This is illustrated in figure 19, which shows a Triumph peach

tree that was budded to the Carman variety when it was 3 years old, after its crop of fruit had been removed. The points where the buds were inserted may be seen by reference to the figure.

If the tree to be top-budded has reached the age when the bark on the main limbs has become too thick and firm to be manipulated readily for budding, it is necessary to head it back somewhat, as when the top is to be replaced with new growth of the same variety, and then insert the buds on the new branches that develop after the tree has been deheaded. When this course is followed the buds should be inserted in the new growth as near the trunk as is prac-

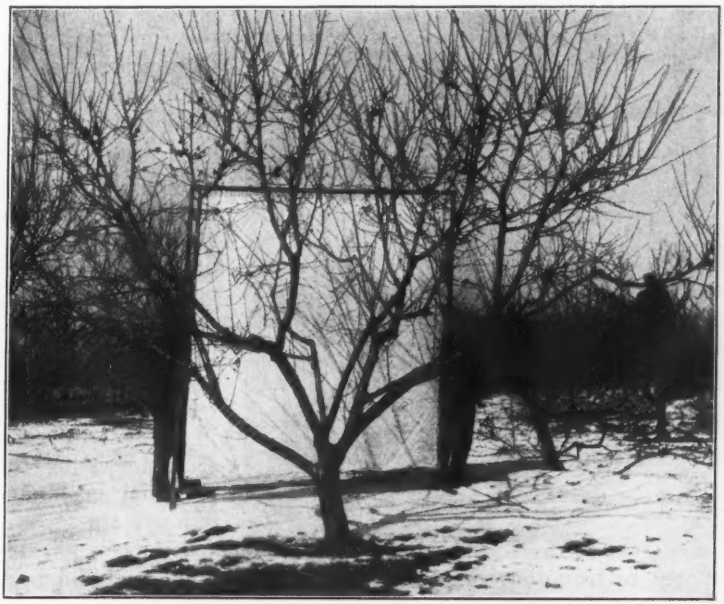

FIG. 13.—A peach tree 8 years old in which the new growth, i. e., the fruit-bearing wood, has been made largely at points far remote from the main limbs.

ticable, in order to have as large a portion of the top as possible of the new variety. This is also desirable on account of the subsequent management of the tree.

Top-working is sometimes done by grafting instead of budding. The ordinary cleft graft is generally used in such cases. However, budding is to be preferred, especially as the wounds made in grafting do not heal readily in the case of the peach, though when properly done the union of stock and scion is generally strong enough to make a fairly serviceable tree. But troubles incident to the difficulties in the healing of the wounds are likely to occur.

THINNING THE FRUIT.

In the minds of some peach growers, to teach the thinning of the fruit is to teach heresy. The thing most desired by them is the biggest peach crop possible. Then the heavier the "set" of fruit the better, and the last consideration is to pick off any of it until it is picked for market. This is their philosophy.

The matter of thinning the fruit on heavily loaded peach trees should require no special argument to establish the wisdom of the practice, but the reasons for thinning may be briefly set forth in the present connection.

The fact is widely recognized that most varieties of peaches, as well as other fruits, for that matter, under favorable conditions often set much more fruit than the tree can possibly develop to a good degree of perfection for commercial purposes. The inherent natural purpose of the tree is to perpetuate its kind. To this end, left to itself, its tendency is to develop the largest possible number of seeds, with each seed possessing the potential possibility of a new tree.

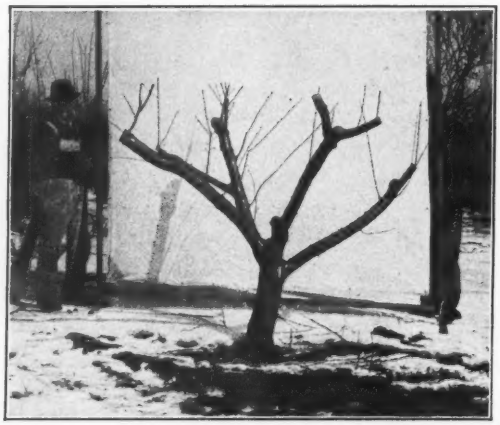

FIG. 14.—The tree shown in figure 13 after being deheaded.

The grower's aim is for the tree to produce the largest possible amount of fruit that can attain the highest commercial standard. The inherent effort of the tree and the object desired by the grower impose, or at least tend to impose, incompatible requirements. The development of a great number of seeds is a tree-exhausting process. This is opposed to the development of large fruits. To meet his ends in this respect the grower has recourse to thinning the fruit.

There is perhaps no operation in the production of peaches which requires keener judgment in order to reap its full benefits than does thinning the fruit. However, no fixed rules for it can be given. It is commonly advised to thin so that the fruits will not be nearer together than 4 to 6 inches. This direction is quite generally applicable, yet it may have several important modifications under different conditions. The strength of the tree, the fertility of the soil, and especially the soil moisture are all coordinate factors governing this

operation. These factors, together with the size of the crop, or, in other words, the number of fruits allowed to develop on the tree, govern very largely the size and perfection of the individual fruits, except as fungous diseases and insects may affect them.

Obviously, a vigorous tree growing under favorable conditions as to moisture, plant food, etc., can develop a larger number of fruits to good size than can a weak tree, or even the same tree when there is a marked deficiency either in the supply of moisture or of plant food.

FIG. 15.—The tree shown in figures 13 and 14 during its secondseason's growth after being deheaded.

The skill of the grower is shown in his ability to adjust the size of the crop on his trees to the varying seasonal conditions. While he is powerless, of course, to add more fruit, it is quite within his power to reduce the number of fruits on the trees if the season becomes very dry as it progresses. Thus the grower should aim to control the size of the individual fruits by thinning and by tillage and pruning.

It is sometimes argued that the expense of thinning makes it prohibitive. But this is fallacious. While it may cost a relatively large amount per tree, it is the experience of the best growers that, as a rule, actually more high-grade fruit is produced on a tree which bears only a moderate crop than on one which is heavily overloaded, and the average fruit on the tree with a moderate crop is of better grade than the best fruit on an overloaded tree.

Another factor is commonly overlooked when the cost of thinning is considered. The operation should be done after the "June drop"—which usually occurs from a month to six weeks after the blossoming period, when the imperfectly fertilized and other weakly developed embryo fruits drop off—and before the pits begin to

harden. After the "June drop" is over there is but very little dropping of the peaches. Hence, practically all of the fruit which remains then will be on the trees at harvest time. It will have to be picked then, anyway. It is a fair assumption that it will cost no more and probably considerably less to pick a portion of the crop in June or July and drop the fruit on the ground than it will to pick it later and put it in a basket, where much of it will have to be handled over several times in grading and packing and then finally large quantities discarded as culls because the fruits are so small. More-

FIG. 16.—An Elberta peach tree 7 years old that was deheaded about as indicated in figure 14, showing its first season's growth after being cut back. It should bear a crop of fruit the following season. (Photographed Aug. 15, 1911.)

over, the fruit on an overloaded tree will sometimes ripen less uniformly than on a tree that has a moderate crop.

It has already been stated that the development of the pits is an exhaustive process. Therefore, the limiting of the number of fruits tends to conserve the vitality of the tree. A large portion of the flesh of the peach is water; hence, if the soil is well supplied with moisture the development of the edible portion of the fruit makes a relatively light demand on the strength of the tree.

CONTROL OF INSECT PESTS AND FUNGOUS DISEASES.

Only incidental reference to insect pests and fungous diseases is consistent in the present connection. This reference is made primarily to call attention to the place which the control of insects and

diseases holds in the successful management of a peach orchard and to indicate the sources of help and information which are available to peach growers.

After a grower has pruned intelligently, tilled and fertilized his orchard well, and irrigated it if that has been required, the orchard may be short lived and the crops financial failures if he neglects to give proper attention to the control of the insects and diseases which habitually occur in his region. While it is true that there are some rather serious peach parasites which are regional in their occurrence and some of those which are widely disseminated remain unknown thus far in certain districts, it is likewise true that a considerable number of both insect pests and fungous diseases are to be found pretty nearly everywhere in the country in which peaches are grown.

FIG. 17.—A peach tree that has been deheaded, but which did not develop a symmetrical top because a portion of the stubs had no buds strong enough to develop branches.

Every fruit grower should be in close touch with the agricultural experiment station in his State, so that he can refer emergency matters there without delay. Not infrequently, the securing of information regarding the control of some insect pest that has become suddenly threatening or concerning the most effective means of checking the spread of a disease hitherto unknown results in saving what would otherwise be a serious loss.

Inquiries relating to any phase of fruit growing may also be referred at any time to the United States Department of Agriculture, where without cost, through the department's pathological, entomological, and other experts, as full information relative to the problems as can be given may be secured.[1]

[1] Farmers' Bulletin 440, entitled "Spraying Peaches for the Control of Brown-Rot, Scab, and Curculio," obtainable from the Department of Agriculture on request, is of value to peach growers who have these troubles to combat.

INTERPLANTED CROPS.

The growing of some annual crop between the trees during the first two or three seasons following the planting of an orchard, as an aid in meeting the cost of maintenance during the unproductive age of the trees, is frequently an economic expediency. This practice is seldom, if ever, any advantage to the trees in comparison with thorough tillage by itself, but if interplanted crops are wisely selected and properly managed with respect to their relation to the trees, they are not likely to result in any serious harm.

FIG. 18.—A peach tree that shows the possibility of developing an entirely new top when the limbs are cut back to the trunk. This is not likely to be successful except on comparatively young trees.

The interplanted crop ought to be one which needs essentially the same tillage that the peach trees should have. Where this is the case, the secondary crop does not seriously interfere with that operation. But the grower should realize that he is, in effect, following a system of double cropping and that because of the interplanted crop he may need to give more attention to the maintenance of the fertility of the soil than he would for the peaches alone.

After the trees reach bearing age, they should not be made to compete with another crop. Even if there is sufficient plant food in the soil to produce successfully two crops at the same time, the peach trees will usually need all of the available soil moisture, except, of course, in sections where irrigation is practiced and there is an adequate supply of water for all purposes. Besides, an interplanted crop would be likely to interfere with the spraying of the trees, if that operation should be necessary, with the harvesting of the fruit, and in other ways.

Provided interplanted crops do not interfere with any of the operations required in the proper development of the trees, a considerable range of choice may be exercised by the grower as to what he shall use. The selection may be governed to some extent by the relative market value of different crops that can be grown in different regions. Muskmelons, beans, peas, cabbages, tomatoes, and other truck crops are extensively grown in this way in different sections. Potatoes are sometimes used, but they are suitable only when the crop can be so managed that the digging of the potatoes will not amount to a late cultivation, which may be attended with undesirable results. Corn, also, is frequently used, but as very often managed it is objectionable, because it shades the trees excessively. Whenever corn is interplanted, an open strip of considerable width should be left along the rows, so that the trees will be fully exposed to the sunlight throughout the season. If a very tall, strong-growing variety of corn is used, a wider strip should be left unplanted than where a dwarf variety is selected.

FIG. 19.—A 3-year-old Triumph peach tree top-budded to Carman after harvesting the season's crop of fruit. This shows the tree about one year after the Carman buds were inserted at *a*, *b*, *c*, and *d*. (Photographed in Georgia, July 16, 1903.)

Peach trees are sometimes used as an interplanted crop, especially where apples comprise the permanent crop. This practice is both highly recommended and emphatically condemned by fruit growers of wide experience. It is probably objectionable in that for a period of years both bearing and nonbearing trees occupy the same area, and it is sometimes desirable to treat a fruiting tree very differently from one that is not fruiting, for the best results with each. On the other hand, where a site is particularly favorable for both fruits, a compromise treatment can often be effected, which yields fairly satisfactory results with both kinds of trees.

SOME SPECIAL PRACTICES.

There are a few special methods and practices in the management of peach orchards which are of sufficient importance in some sections to justify brief reference to them here.

The Ohio Agricultural Experiment Station has called attention to the efficacy of slightly mounding up the soil about the base of the trees in preventing injury during periods of excessively low winter temperatures. In the same connection it has been shown that various other factors relating to the soil may greatly influence the amount of damage which peach trees suffer during such periods.

The winter of 1903–4 was characterized in the Lake Erie peach district of Ohio by periods of severe and prolonged cold. Great numbers of peach trees were killed. The prevailing conditions and their attendant results on the peach trees are summarized as follows: [1]

> Exceptional causes of susceptibility to cold in rare cases of apparently healthy, vigorous trees: Low, moist, rich black soil which favored an extreme growth of soft, poorly ripened, or matured wood; or high culture upon soil rich in plant food which brought about similar results.
>
> The unusually deep, hard freezing of the earth's crust was due, directly, to the continued, steady cold, but was intensified, in many instances, by a lack of humus or vegetable matter in the soil, which constitutes nature's insulation of the surface of the earth from cold and heat.
>
> Providing that the orchards had been kept free from fungous disease and the San Jose scale by timely and thorough spraying, no injury of trees was found where stable or barnyard manure had been used upon the ground within the last year or two previous to the winter of 1903–4; rarely was an injured tree found standing in sod; no injury was done where the surface of the soil beneath the trees had been covered with even a very slight mulch; little injury was done where the trees stood in fairly well-drained soil containing a moderate amount of fertility and humus; no injury was found where the trees were under the grass-mulch method of culture . . .; no injury was observed in any case where the stems of the trees had been slightly banked or mounded with a few shovelfuls or forkfuls of soil, peat, or manure.
>
> Very few trees which, within the past few years, had been affected with leaf-curl or infested with San Jose scale or borers remained alive or uninjured; and very few trees existing upon infertile or exhausted soil, depleted of humus, escaped uninjured.

The usefulness of a cover crop in preventing the washing of the soil during the dormant period of the trees is frequently well demonstrated. Moreover, in some regions where the winters are rather severe and there is a very limited snowfall, a cover crop prevents the snow from blowing away, thus affording additional protection against the extreme freezing of the roots.

Another practice which is entirely regional, but which may be of considerable advantage at times, is the shading of the trunks of the trees with board protectors, lath screens, or in some other equally effective manner. This method is of use particularly in regions in which long periods of extremely hot weather usually occur and where

[1] Ohio Agricultural Experiment Station Bulletin 157, "Winter-Killing of Peach Trees," p. 132.

the trees are not well shaded on the south and southwest sides. Shading in the manner suggested sometimes affords a measure of protection against the form of winter injury commonly called "sun scald." This is generally caused by too rapid thawing after the trunks have been frozen very hard.

SOME IMPORTANT CORRELATIONS.

In nearly all of the experiment-station bulletins on peach culture, in current horticultural literature, and in the standard works in which peach growing is discussed in detail, emphasis is habitually placed upon the necessity of so managing the orchard that the trees will cease growing and the wood will become fully mature before the advent of cold weather. Otherwise, serious winter injury is anticipated. To accomplish this end it is generally advised to cease tillage in July or early August, to withhold fertilizers rich in nitrogen, and to avoid excessively fertile soil in selecting sites for peach orchards.

Undoubtedly such advice is perfectly sound and applicable to a large proportion of the peach-growing districts, but there appear to be some rather marked exceptions that are applicable in important peach-growing sections, to which the reader's attention may well be directed.

These exceptions to the general practices have been brought to light largely through investigations carried on by the Missouri Agricultural Experiment Station.[1] They consist primarily in so managing the orchard as to maintain the trees in active growth until rather late in the season. This may be accomplished by continuing the tillage later than is ordinarily advised, by using a nitrogenous fertilizer, or by heavy pruning, which results in a vigorous growth of new wood. Any condition that seriously reduces the vitality of the tree tends to make the tree, especially the fruit buds, susceptible to injury by winter temperatures. The production of an excessive crop of fruit is a common cause of depleted vitality. The conclusions of the Missouri experiment station tentatively summarized are as follows:[2]

> Where nitrogen was applied to peach trees a good crop was produced and harvested. On plats receiving no fertilizer there was practically no crop. There was likewise a failure of peaches in the surrounding region where no fertilizer was applied. The cold winter of 1911–12 was disastrous to peach trees in Missouri. Injury to peach trees caused by the cold so weakened their vitality that disease like the bacterial shot-hole leaf disease was common. On the plats fertilized with nitrogen there was little

[1] Missouri Agricultural Experiment Station Bulletin 74, entitled "The Winter-Killing of Peach Buds as Influenced by Previous Treatment."

Missouri Agricultural Experiment Station Circular of Information 31, entitled "Hardiness of Peach Buds, Blossoms, and Young Fruit as Influenced by the Care of the Orchard," being a reprint from the Annual Report of the Missouri State Board of Horticulture, 1908.

Missouri Agricultural Experiment Station Bulletin 111, Report of the Director for the Year Ending June 30, 1912.

[2] Missouri Agricultural Experiment Station Bulletin 111, Report of the Director for the year ending June 30, 1912, p. 247–248.

bacterial disease. On adjacent unfertilized plats the injury from this cause was very great. The trees in the plats fertilized with nitrogen also recovered from winter injury much more successfully and quickly than unfertilized trees in the same locality.

The application of phosphorus and potassium either singly or in combination did not result in increased yields. The results of the investigations on fertilizers for peaches seem to indicate clearly that a nitrogenous fertilizer or a method of cultivation and management which favors a vigorous tree growth when combined with pruning, spraying, and thinning fruit on overloaded trees will increase the crop. The above treatment tends to make them carry their fruit buds through winter and frosts of spring much more safely than where an average or weak growth only is secured. Our results seem to disprove the theory that trees must make their main growth early in the season and then be checked or retarded in their growth in August or September in order to ripen their wood before going into winter. In some experiments at this station where the trees have been encouraged to grow vigorously right up until some of the green leaves froze on the trees, either by the use of fertilizer or by severely pruning back the winter before or by thinning the fruit, they have uniformly carried their fruit buds through the winter much more safely than with trees that shed their leaves and ripened their wood early.

A very careful correlation of these results with the conditions which are generally considered essential in the growth of peach trees in the northern districts is necessary in order to understand their significance. There is no real conflict or lack of harmony in the methods advised for the different regions, though in the abstract they may appear to be directly incompatible.

On the other hand, they illustrate very forcefully the fact that the blind application of definitely stated rules is likely to work disaster. The importance of intelligently adapting the methods used to the conditions which have to be met in different fruit-growing regions is emphasized.

The differences in the conditions in the northern peach districts and in those met in connection with the investigations of the Missouri experiment station are largely differences in the climate during the winter season.

In the northern districts, the normal winter is continuously cold and without any warm spells of sufficient duration to affect the dormancy of the trees. It usually remains cold until winter finally breaks. When it warms up enough to start the trees into activity and cause the buds to swell, there is comparatively little danger thereafter of serious frosts or freezes. Moreover, the critical factor—the one which largely governs the management of the orchard in the present connection—is low winter temperatures which are sufficient to kill the buds or injure the trees even when they are perfectly dormant. To best meet this low-temperature factor, it is recognized that the trees must be thoroughly dormant and the current season's growth well ripened.

In regions where the Missouri methods are applicable, critically low winter temperatures are of little concern, provided the trees are in a

dormant state. But the winters are characterized by warm spells in December, January, and perhaps in February, which are sufficient to start the buds. This makes them tender and susceptible to injury later in the season by temperatures that are entirely seasonable and which would be of no concern to the peach grower if the buds were dormant. The trees often blossom early and before the season of spring frosts is past.

The reason for continuing the growth of the trees until late in the season in these regions is based on the fact, the practical importance of which is shown in the investigations referred to, that the rest period, or period during which the trees normally remain dormant, is one which by nature continues for a fairly definite period of time. Until that period is past, when once they have become dormant, the trees do not respond readily to temperatures which later would cause them to resume a more or less active condition and result in the buds swelling enough to make them tender.

This is a matter that is relatively unimportant in regions where the entire winter season is normally characterized by temperatures which are not sufficiently high to affect vegetation, but it has a very important significance in the regions in which warm periods of considerable length occur during the winter. If all the agencies which tend to stimulate the growth of the trees are discontinued relatively early in the season, the trees will cease growing and begin to ripen their wood at a correspondingly early date; the resting period inherently required by the trees is then completed early in the winter. If a spell of warm weather occurs soon after that period is ended, as, for instance, in January, the trees will respond to it; the buds will begin to swell and soon become tender. On the other hand, if the growth of the trees is continued actively by means of late tillage, nitrogenous fertilizers, or in other ways, until the near approach of cold weather, the period of rest and dormancy inherently required by the trees is not completed until a correspondingly later time in the winter. Under these conditions the trees remain inactive during warm spells in December or January, and the buds do not swell enough to become tender until many of the dangers incident to adverse winter temperatures are past.

While the application of these methods, which have in view the results that follow the continuation of active tree growth until late in the season, may be somewhat restricted, they are undoubtedly worthy of the most careful consideration by peach growers who are located in regions where the winters are characterized by warm periods of sufficient length to cause the trees to become more or less active before settled spring conditions arrive.

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